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**VEGETABLE-BASED COMPOSITIONS AND ARTICLES, AND
METHODS OF MAKING SAME**

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VEGETABLE-BASED COMPOSITIONS AND ARTICLES, AND METHODS OF MAKING SAME

FIELD OF THE INVENTION

The present invention relates to vegetable-based compositions, articles of manufacture
5 containing these compositions and to methods of manufacturing such articles. According to
preferred aspects of the invention, the article is a candle with desirable aesthetic properties
and/or improved mold-release properties.

BACKGROUND OF THE INVENTION

Vegetable waxes have been used for centuries to make articles of manufacture,
12 particularly candles. Although the use of candles has obviously been supplanted as a primary
source of light in most cultures, candles are nevertheless used for a large number of diverse
reasons, including to enhance the decoration, atmosphere and mood of the locations in which
they are used. Accordingly, while it remains necessary that candles be manufactured from
materials and in a manner that ensures that will burn in pleasing way (e.g., without excessive
15 smoke or soot), there has been an increasing desire to obtain candles with pleasing visual
features.

For example, it has been reported in U.S. Patent No. 5,762,487 - Kujawski (which is
incorporated herein by reference) that many varied and relatively complex techniques have
been used to produce candles with interesting decorative effects. For example, the Kujawski
20 patent describes candles made by a casting method in which the mold is filled with discrete
layers of wax of different colors and then tilted to produce angled stripes of different colors.
This patent also discloses candle making techniques which involve creating a random mosaic
effect by adding solid wax chips of various colors to the mold and then filling with a molten
wax. Other complex decorative techniques are also disclosed, such as aerating the wax before
25 or after it is poured into the mold and adding pieces of ice to the wax to create a honeycomb
effect.

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While the above techniques may have been successful in creating interesting decorative effects, they are all relatively complex, time consuming and/or labor intensive procedures which ultimately add cost to the finished product. Furthermore, certain of the materials which have heretofore been used to manufacture candles have become increasingly disfavored in recent years. For example, the Kujawski patent discloses that the candles are preferably formed from petroleum based waxes (i.e., paraffin waxes). However, petroleum products have become increasingly expensive and are a further concern because they represent a non-renewable resource. As a result it has become increasingly desirable to produce "green" candles, that is, candles which do not contain petroleum derived products. Furthermore, although Kujawski discloses that beeswax may be used as alternative to petroleum-based waxes, the formation of candles exclusively from beeswax is generally disfavored from a cost perspective due to the relatively high cost of beeswax.

U.S. Patent No. 6,063,144 - Calzada, which is incorporated herein by reference, discloses a candle formed from non-paraffin materials consisting essentially of at least 30 parts by weight of stearic acid, at least 5 parts by weight of vegetable-derived wax with a melting point of at least 50°C, vegetable oil, fragrance and an oxidation inhibitor. The Calzada patent does not disclose that the article formed from such a composition has advantageous aesthetic qualities or decorative effects.

In view of these and other potential deficiencies in the techniques and materials heretofore used to produce candles and other articles, the present inventor has developed articles which can be efficiently manufactured while at the same time possessing unique and highly attractive decorative effects.

BRIEF DESCRIPTION OF THE FIGURES

Attached as Figure 1 is a series of photographs showing candles made in accordance with one embodiment of the present invention.

Attached as Figure 2 is a series of photographs showing candles made in accordance with a second embodiment of the present invention

Attached as Figure 3 is a series of photographs showing candles made in accordance with a third embodiment of the present invention.

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Attached as Figure 4 is a series of photographs showing candles made in accordance with a fourth embodiment of the present invention.

Attached as Figure 5 is a series of photographs showing candles made in accordance with a fourth embodiment of the present invention.

5 Attached as Figure 6 is a photograph which shows a candles which does not achieve the preferred decorative effects of the present invention.

Attached as Figure 7 is a photograph which shows candles made in accordance with the present invention in a variety of colors, shapes and sizes.

DESCRIPTION OF THE INVENTION AND PREFERRED EMBODIMENTS

10 The Compositions and the Articles

The present inventor has discovered that desirable articles of manufacture can be obtained by the use of compositions comprising, on a relative basis, from about 80 parts to about 99 parts by weight of vegetable-derived compound(s) and from about 1 part to about 20 parts by weight of insect wax. According to preferred embodiments, the article is a molded
15 candle which exhibits one or more of a variety of decorative effects, as described in more detail hereinafter. According to highly preferred embodiments, the candle body of the present invention consists essentially of vegetable-derived compound(s) and insect wax.

The term "vegetable-derived compound(s)" as used herein refers to any single compound or combination of compounds which are of the type commonly derived from
20 vegetable or fruit sources. Although it is contemplated that any vegetable-derived compound(s) may be adapted for used in accordance with the present invention, it is generally preferred that the vegetable-derived compound(s) comprise, and even more preferably are selected from the group consisting essentially of vegetable waxes, vegetable acids and combinations of acids and waxes of the type derived from vegetable and fruit sources. The
25 term "consisting essentially of" is used herein in its art-recognized sense to express that the composition is open to the inclusion of additional ingredients in amounts which do not adversely affect its novel and basic properties.

For embodiments which incorporate vegetable acids, it is generally preferred that the vegetable acid comprise, and preferably consist essentially of, stearic acid. As used herein,

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the term "stearic acid" includes any of the commercial grades of stearic acid. While academic authorities and textbooks treat "stearic acid" as a synonym for the pure chemical compound octadecanoic acid ($C_{17}H_{35}COOH$), commercial practice, which is the intended meaning herein, is broader and uses the same term for mixtures comprising major amounts of one or more of both octadecanoic acid, the 16 carbon hexadecanoic acid or palmitic acid ($C_{15}H_{31}COOH$), together with minor amounts of lower and higher homologs, the corresponding monounsaturated acids 9-Octadecanoic acid (oleic acid, $C_{17}H_{33}COOH$) and 9-Hexadecanoic acid (palmitoleic acid, $C_{15}H_{29}COOH$) and a variety of trace impurities characteristic of the source of the raw material and the method used in its refining. Furthermore, it will be appreciated that while the stearic acid used in accordance with the present invention is preferably obtained by the processing of vegetable materials, it will be appreciated that stearic acid compounds may be derived from other sources and are considered within the scope the term "vegetable-derived compound(s)" as used herein.

According to certain preferred embodiments, the vegetable acid of the present invention comprises one or more compounds corresponding to the formula C_xH_yCOOH , where x is from about 15 to about 17 and y is from about 29 to about 35.

Likewise, while the vegetable waxes used in accordance with the present invention are preferably obtained by the processing of vegetable materials, it will be appreciated that such wax compounds may be derived from other sources and are considered within the scope the term "vegetable-derived compound" as used herein. In other words, it is considered that synthetic forms of, or substitutes for, the vegetable waxes and vegetable acids are within the meaning of those terms as used herein.

Commercially available stearic acid is sold by Procter & Gamble Chemicals under the trade designation V-1855 and is preferably used as the vegetable acid component of the present compositions.

Commercially available palmitic acid is sold by Procter & Gamble Chemicals under the trade designations V-1695 and V-1655 and is preferably used as a vegetable acid component in certain embodiments of the present compositions.

With respect to the vegetable wax compounds, particularly preferred compounds are palm-derived waxes, candelilla waxes, cork fiber waxes, hemp fiber waxes, sugar cane waxes, bayberry waxes, Japan waxes, bamboo leaf waxes, rice waxes, esparto wax, and mixtures and

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combinations of these. In general, palm-derived waxes are preferred and include carnauba wax, ouricury, caranda' and raffia. As is known, palm derived waxes generally contain high concentrations, for example, from about 80% to about 90% of alkyl esters of higher fatty acids. Such esters may include esters of palmitic acids, stearic, oleic acids and combinations of two or more of those.

In general, the vegetable wax of the present invention preferably is comprised in major proportion of palmitic ester waxes, and even more preferably the vegetable wax comprises at least about 70 % by weight of esters derived from palmitic, stearic or oleic acids, with at least about 80 % by weight of such esters being even more preferred. According to highly preferred embodiments, the vegetable wax component of the present compositions comprises, and preferably consist essentially of, lower alkyl ($C_1 - C_4$) esters, and even more preferably methyl esters, of stearic acids. Among the preferred methyl esters of stearic acid are methyl ester of hexadecanoic acid and methyl ester of octadecanoic acid. A combination of methyl ester of hexadecanoic acid and methyl ester of octadecanoic acid is sold by Procter & Gamble Chemicals under the trade designation CD-1618H and is preferably used as the vegetable wax component of the present composition.

The vegetable-derived compound(s) preferably comprise a major proportion, on a relative weight basis, of stearic acid and minor proportion of esters of stearic acid. Preferably the vegetable-derived compound(s) comprise, on a relative basis, from about 70 to about 90 parts by weight of stearic acid and from about 10 parts by weight to about 30 parts by weight of esters of stearic acid.

The present inventor has found that compositions comprising a major proportion of vegetable-derived compound(s) and from about 1 % by weight, and even more preferably from about 2 % by weight, up to about 20 % by weight of insect wax (based on the combined weight of vegetable-derived compound(s) and insect wax) is capable of producing unique and highly desirable aesthetic properties. More particularly, the compositions, when formed into shaped articles, and particularly candles, exhibit a variety of surface appearances which flow from the combinations described herein without the need for any additional or complex decorating procedures. Applicant has found that the desirable aesthetic effect is generally not achieved at insect wax concentrations below about 1% or at about 20% or above.

Furthermore, as explained in connection with the method aspects hereof, amounts of beeswax

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below about 1% do not provide certain processing advantages that are obtained when concentrations within the described range are used. In addition, applicant has found and believes that the advantageous aesthetic features of the present invention are not achieved with compositions which eliminate the vegetable-based compound(s) and utilize instead petroleum-derived compounds of the types which have heretofore used in the manufacture of candles.

The term "insect wax" as used herein refers not only to waxes produced by naturally occurring insects, but also any waxes produced by genetically altered insects and to waxes produced synthetically as insect wax substitutes. Synthetic substitutes for insect wax are disclosed in U.S. Patent Nos. 4,500,359, 4,292,008 and 4,151,00, each of which is incorporated herein by reference.

The preferred insect wax in accordance with the present invention is beeswax. In general, based on various publications, beeswax contains of 10.5 - 14% hydrocarbons, 71 - 72 % alkyl esters of monocarboxylic acids, 0.6 - 0.8 % cholesteryl esters, 12% - 14.5 % free acids, 1 - 1.5 % free alcohols, and other ingredients, including coloring matter, lactone, moisture and mineral impurities. See *Van Nostrand Reinhold Encyclopedia of Chemistry* (4th Edition); *Beeswax-Composition and Analysis*, by Tulloch, National Research Council of Canada; and U.S. Patent No. 4,151,001, each one of which is incorporated herein by reference.

In general, the simple esters of beeswax are comprised in major proportion of palmitate compounds, including myricyl palmitate.

The reason that the combination of vegetable-derived compound(s) and insect waxes in accordance with the present invention produces articles with the aesthetic effects discovered by the applicant is not fully understood.

With reference now to Figure 1, color photographs of two cylindrically shaped articles in accordance with the present invention are shown. These articles each exhibit a visual effect which is described herein as a thumb-print pattern. This pattern is achieved with insect wax in amounts of from about 2% to about 6% of the composition. The articles in Figure 1 contain about 2% and 3%, respectively from left to right, of beeswax with the remainder being vegetable-derived compound(s) comprising about 80 parts by weight of V-1855 and 20 parts by weight of CD-1618H.

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With reference now to Figure 2, color photographs of three cylindrically shaped articles in accordance with the present invention are shown. These articles each exhibit a visual effect which is described herein as cellular or tortoise shell pattern. It should be noted that these articles include a thumb-print pattern within each cell of the tortoise shell pattern.

5 This combination of patterns is highly preferred, and is generally achieved only with compositions that contain insect wax, and preferably beeswax, in amounts of from about 4% to about 6% of the wax component of the composition. The articles in Figure 2 contain about 4% , 5% and 6%, respectively from left to right, of beeswax with the remainder being vegetable-derived compound(s) comprising about 80 parts by weight of V-1855 and 20 parts

10 by weight of CD-1618H.

With reference now to Figure 3, color photographs of four cylindrically shaped articles in accordance with the present invention are shown. These articles each contain tortoise shell pattern. However, each cell or bordered segment which is part of the overall tortoise shell pattern is made from or contains what is referred to herein as a sunburst pattern. This

15 combination of patterns is preferred in certain embodiments, and is generally achieved only with compositions that contain insect wax, and preferably beeswax, in amounts of from about 7% to about 10% of the wax component of the composition. The articles in Figure 3 contain about 7%, 8%, 9% and 10%, respectively from left to right, of beeswax with the remainder being vegetable-derived compounds comprising about 80 parts by weight of V-1855 and 20

20 parts by weight of CD-1618H.

With reference now to Figure 4, color photographs of two cylindrically shaped articles in accordance with the present invention are shown. These articles each exhibit a visual effect which is described herein as marble pattern. It should be noted that these articles generally do not contain either a thumb-print pattern or a sunburst pattern effect. The marble pattern is

25 generally achieved only with compositions that contain insect wax, and preferably beeswax, in amounts of from about 11% to about 12% of the wax component of the composition. The articles in Figure 4 contain about 11% and 12 6%, respectively from left to right, of beeswax with the remainder being vegetable-derived compounds comprising about 80 parts by weight of V-1855 and 20 parts by weight of CD-1618H.

30 With reference now to Figure 5, color photographs of three cylindrically shaped articles in accordance with the present invention are shown. These articles each exhibit a

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visual effect which is described herein as spotted or mottled pattern. It should be noted that ceratin of these, particularly the article in picture on the left side of the figure, also include elements of the marble pattern. The spotted patterns is generally achieved only with compositions that contain insect wax, and preferably beeswax, in amounts of from about 13% to about 15% of the wax component of the composition. The articles in Figure 5 contain about 13%, 14% and 15%, respectively from left to right, of beeswax with the remainder being vegetable-derived compounds comprising about 80 parts by weight of V-1855 and 20 parts by weight of CD-1618H.

With reference now to Figure 6, a color photograph of a cylindrically shaped articles that does not exhibit the preferred pattern effect of the present invention is shown. The article in Figure 6 contains about 20% of beeswax and 80% by weight of being vegetable-derived compounds comprising about 80 parts by weight of V-1855 and 20 parts by weight of CD-1618H.

The compositions of the present invention, and the articles from which they are made, therefore preferably comprise, and even more preferably consist essentially of, from about 70 parts by weight to about 98 parts by weight of vegetable-derived compound(s), and insect wax (preferably beeswax) in an amount of from about 2 parts by weight to about 15 parts by weight, more preferably in amounts of from about 4 parts to about 15 parts by weight, and even more preferably in amounts of from about 4 parts to about 12 parts by weight. It will be appreciated, of course that other components, such as perfumes, fillers, dyes, etc. may be included in the compositions and articles hereof without detriment.

Furthermore, it will be appreciated that the present articles can be formed from material other than the present composition, provided the present composition is utilized to provide at least one visual surface portion of the article. This could be achieved, for example, by coating or layering the present composition onto a support structure formed from other components. However, it is preferred in many embodiments, such as candles for example, that the article be formed in substantial portion from the present compositions. Such articles will receive the benefit of achieving a through-pattern feature for the article, that is, the decorative effect will exist throughout the article, and not just on a localized surface or area thereof. As a result, the effect will remain visible from all angles even as the candle burns.

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The Methods

It is contemplated that many methods may adapted to form the present compositions into articles, and articles made by all such methods are within the scope hereof. However, the present compositions exhibit additional advantage when used as the material for molding or casting techniques. More particularly, such techniques utilize a mold which defines a cavity having the desired geometry of the article being produced. The present composition, preferably in molten form, is introduced into the mold, preferably by pouring, to fill the cavity and thereby taken on the desired shape. In the case of candle making, the process also generally includes placing a wick into the cavity of the mold, for example by suspending the wick from a cross-bar over the mouth of the mold, and then placing the molten wax into the mold and around the wick. The wax is then allowed to solidify, and once the wax has set, the candle is removed from the mold.

Applicants have noted a significant processing advantage associated with the compositions of the present invention when used to make articles by the molding process. More particularly, applicants have noted that the ease with which the article is removed from one-piece molds is greatly enhanced by the incorporation of insect wax into the present compositions. Although applicant does not intend to necessarily bound by its theory of operation, it is believed that vegetable-derived compounds, and particularly the preferred vegetable acids and waxes, undergo no substantial shrinkage upon solidification and setting in the mold. As a result, it can sometimes be difficult to remove the shaped article from a one piece mold. Applicant has found that the addition of as little as 1%, but preferably at least about 3%, by weight of insect wax to the composition produces just enough shrinkage of the article, without materially effecting the overall shape or integrity of the article, to greatly enhance the ease with which the article can be removed from the mold. Of course, to further facilitate removal of the article from the mold, release agents can be applied to the inside surfaces of the mold or introduced into the composition. Furthermore, numerous materials can be used to form the mold, such as glass, metal (including aluminum), plaster, or even cardboard.

The following examples are illustrative of the compositions, articles and process of the present invention and should not be considered as limiting the scope of the invention in any way.

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EXAMPLE 1

Each of the following compositions was made from a vegetable-derived compound comprising about 80 weight percent of V-1855 and 20 weight percent CD-1618H. A series of compositions were made comprising this vegetable compound and beeswax comprising the balance of the composition in amounts of 0, 1, 2, etc. to 20 percent by weight, hereinafter referred to as Compositions 0 through 20.

Each composition was melted, blended thoroughly to produce a substantially homogeneous mixture, poured at 140°F into 1.875-inch aluminum candle molds, and allowed to harden at room temperature overnight. Composition 0, containing no beeswax, was difficult to remove from the mold. Composition 1, with 1 percent beeswax, shrank slightly from the mold and released more easily than Composition 0. Composition 2, with 2 percent beeswax, released easier than Sample Composition 1. Compositions 3 through 20 all shrank sufficiently from the mold to release easily after solidification.

EXAMPLE 2

A candle wax compositions is made from a vegetable-derived compound comprising about 80 weight percent of palmitic acid (V-1695) and 20 weight percent CD-1618H. A series of compositions are made comprising the vegetable derived compound, with the balance being quantities of from 1 to about 20 percent by weight beeswax. These compositions are melted, blended thoroughly to produce a substantially homogeneous mixture, poured at 140°F into 1.875-inch aluminum candle molds, and allowed to harden at room temperature overnight. These compositions all shrink from the mold and release more easily than compositions without beeswax.

EXAMPLE 3

A candle wax compositions is made from a vegetable-derived compound comprising about 50 weight percent of palmitic acid (V-1655) and 50 weight percent V-1855. A series of compositions are made comprising this vegetable derived compound, with the balance being quantities of from 1 to about 20 percent by weight beeswax. These compositions are melted, blended thoroughly to produce a substantially homogeneous mixture, poured at 140°F into 1.875-inch aluminum candle molds, and allowed to harden at room temperature overnight.

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These compositions all shrink from the mold and release more easily than compositions without beeswax.